

MAMMALOGY

Project title: Fecundity and Fawn Mortality of Northern Yellowstone Pronghorn

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Objective: The purpose of this research is to obtain an estimate of annual fecundity and offspring survival of pronghorn females, and to describe the age schedule of fawn mortality. In May through June 2000, we located collared females daily, or as frequently as possible, to record pregnancy status and birth date. We captured fawns of these females to record limb length and body mass, and to attach solar-powered ear tag transmitters. We checked radio signals daily and attempted to make daily observations of females whose fawns we were unable to catch. In the final two weeks of August, we counted all pronghorn, including all surviving fawns.

Findings: 1) **Pregnancy Status:** Of the 26 females that we observed during the fawning season, we classified two as not pregnant. It is possible that these females lost fawns early, before we first located them. The minimum pregnancy rate is $24/26 = 92.3$ percent; 2) **Birth Dates:** We obtained good estimates of the birthing dates for 10 females that gave birth between 22 May and June 10. The median date was May 30; 3) **Birth Mass:** We weighed 11 fawns. The median age at capture was three days. Mean adjusted birth mass [Mass at capture - (days age at capture \times 0.2446)] was 3.12 kg; 4) **Birth Sex Ratio:** Of the 13 fawns that we captured, or observed closely enough shortly after birth to ascertain sex, five were male and eight were female. In the late summer count of 35 surviving fawns, 17 were male, 16 were female, and 2 were of unknown sex; 5) **Fawn Survival:** We fitted 12 fawns with radio transmitters, and knew the fates of two others. All 14 fawns died between 1 and 25 days of age. The median age at death was 14 days. We recovered three radio ear tags at the mouths of coyote dens; 6) **Adult Mortality:** Seven radio collared females died. The death rate of adult females in 2000 was $7/27 = 25.9$ percent. This was significantly greater than the rate of the preceding year, which was $1/24 = 4.2$ percent. Five of the seven deaths occurred within three weeks of birth and only one of these seemed attributable to other than external causes. Four females died on winter range. We saw one of these killed by a coyote and the deaths of the other three are consistent with coyote predation. It may be that there are a few coyotes on winter range that have developed the ability to kill adults and have their greatest success at this when mothers attempt to defend young fawns; 8) **Location-Specific Survival of Fawns:** Late August counts revealed that fawn recruitment was much higher in the eastern portion of summer range than elsewhere. These data hint at the possibility that fawn recruitment on wolf territories is higher than recruitment off wolf territories.

Project title: Carnivore Detection Survey

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Objective: 1) Assess several methods to inventory and monitor medium-sized carnivores: weasels, otter, wolverine, marten, fisher, lynx, bobcat, mountain lion, fox, coyote, and gray wolf; 2) Examine various habitat and landscape characteristics related to their presence/absence; 3) Conduct presence/absence surveys in Yellowstone National Parks and surrounding wilderness areas.

Findings: 1) During the winters of 1990 through 1997 we conducted detection surveys and evaluated three methods: hair snares, remote camera stations, and snow track transects. Their utility as estimates of presence, distribution, and abundance were evaluated, as well as their cost, maintenance, reliability, precision, and bias. Response to hair snares and camera stations were variable locally and between years. Hair snares have the exceptional advantage of providing DNA and potentially identifying individuals, but has the disadvantage of relatively high maintenance and cost and provided unreliable results from the analysis of hair characteristics. Camera stations, like hair snares, performed well in adverse weather and can identify individuals, but suffer from avoidance bias by several resident species. Camera stations were costly in terms of expense and maintenance. Snow track transects identified four species not detected by other methods and were simple, low cost, and low maintenance. They provide precise habitat information, whereas camera stations and hair snares are baited with food and scent lures which bias results concerning habitat use. Snow track transects allow researchers coverage of large areas and habitat types and can provide valuable information if scats are found and if DNA is successfully extracted. The reliability of species identification from snow track transects is a major disadvantage due to poor climatic conditions and the similarity of many species' track characteristics. Although the specifics of objectives and logistics should dictate use of these methods, we suggest a variable combination of all three methods for determining presence and distribution. All methods have significant problems, especially when inferring abundance. Determining relative habitat use from snow track transects proved reliable and matched that known from previous studies. We prepared a manuscript on the evaluation of three detection methods for medium-sized carnivores. This project resulted in the confirmation of fisher in the Yellowstone Ecosystem. Efforts in year 2000 focused on further analysis of data and preparation of manuscripts for publication.

Project title: Study of Grizzly Bear Behavior and Genetics

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Additional investigator(s): Marilyn French

Objective: Continuation of a long term study of grizzly bear behavior and the use of nuclear DNA markers to determine genetic diversity and population estimates.

Findings: Thirty-four new nuclear DNA microsatellites have been developed from a grizzly bear genome and the genetic profiles for 155 grizzly bears have been determined.

**Project title: Development of Aerial Survey Methodology for Bison Population Estimation
in Yellowstone National Park**

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Additional investigator(s): Steven C. Hess, L. Lee Eberhardt

Objective: The overall objective of this study is the development of aerial survey methodologies for statistically rigorous estimation of the bison population in the Yellowstone area that will have sufficient power and precision to detect demographic trends. These methodologies will allow NPS resource managers to conduct aerial surveys that provide scientifically defensible population estimates to address ecological conditions and epidemiological management issues of Yellowstone bison.

Findings: The survey methodology we are developing quantifies a sampling universe and sampling units with computer geographic information systems, standardizes search effort, employs a stratified sampling design which accounts for undetected animals, and uses an aircraft global positioning system to record data locations. Including seasonally occupied areas outside YNP boundaries, 76 survey units with area of 2,339 km² comprise the entirety of our designated survey extent, roughly equivalent to 26 percent of the area of YNP. The same survey units and total extent are used both in winter and in summer, but survey units have different strata designations for each season. During winter, 52 percent of the entire survey area is designated to be in the high density stratum, while in summer, 41 percent of this area is in the high density stratum. For this research, we enumerated all survey units in the seasonal high density stratum during each survey, and enumerated the low density stratum over the course of each season from February 1998 until August, 2000. Concurrent intensive ground surveys, or 'double sampling', in the Madison-Gibbon-Firehole areas and the Northern Range in winter, and Hayden Valley in summer were used to estimate the magnitude and variability in detection probability during specific aerial surveys. In comparing these simul-

taneous ground and aerial surveys primarily in winter, only 80.7 percent of the groups were detected on average from aircraft, although 93.7 percent of individual bison were detected. During the summer breeding period, as much as 70 percent of the entire bison population is aggregated in significantly larger, highly visible groups in Hayden Valley than observed during winter. Conducting surveys during this time may provide for both higher detection probability and smaller spatial extent than in winter, when bison occupy a larger area, and occupy thermal habitats that have unfavorable background color. We found detection probability to be relatively high in comparison to aerial surveys of other species, although many small groups and solitary bison were not detected from aircraft, which biases population estimates downward. Preliminary results show that low variability between counts and high detection probability provide population estimate with an overall coefficient of variation of roughly 8 percent. We are currently using Monte Carlo simulations to evaluate the efficiency of different stratified sampling designs. Our field research is now completed and we are conducting final analyses and manuscript preparation. We presented preliminary results at a national conference of The Wildlife Society in Nashville, Tennessee in September 2000.

**Project title: Some Population Characteristics of the
Yellowstone National Park Bison Herd. 1996–2001**

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Additional investigator(s): Edward M. Olexa, Kevin M. Podruzny, John A. Mack

Objective: To determine basic population parameters of Yellowstone National Park bison.

Findings: Data analysis continues and population modeling has begun.

Project title: Seasonal Habitat Selection by Bison in YNP

Principal investigator: Dr. Peter Gogan

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Additional investigator(s): Edward M. Olexa, John A. Mack

Objective: To determine habitat selection by bison relative to habitat variables such as to habitat conditions such as topography, fire history, vegetative cover types, and geothermally-heated soils.

Findings: Radio-tracking ended in fall 2000. Data analysis and report preparation have been ongoing since that time.

Project title: Population Dynamics of the Yellowstone Grizzly Bear

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Additional investigator(s): Mark Haroldson

Objective: To describe the population trend from threatened status to recovery and approximate stability.

Findings: These data includes information collected by the Interagency Grizzly Bear Study Team (members include USGS-BRD, YNP, WYDGE, IDFG, MTDFWP, USFWS, USFS) for the entire Greater Yellowstone Area. Data obtained within YNP is not broken out separately): Fifty-four individual grizzly bears were captured a total of 65 times during the 2000 field season in the Greater Yellowstone Area (GYA). Thirty-two captures were new individuals that had not been previously marked. Twenty-seven captures of 24 bears were the result of management trapping efforts. Twelve of these instances resulted in relocation of the nuisance bear(s). Five management captures resulted in the removal of nuisance individual(s). A total of 1,039 aerial radio-locations were obtained from 84 individual grizzly bears radio-monitored during all, or a portion of the 2000 field season. Twenty-eight of the grizzly bears radio-monitored were adult females.

Two rounds of observation flights were conducted as part of our effort to count unduplicated females with cubs-of-the-year and document distribution of females with young (cubs, yearlings, or 2-year-olds). The first round of flights began June 5. Thirteen grizzly bears were observed in 10 groups during 47 hours of flying before we curtailed flights due to bad weather and poor bear sightability. The second round of flights began on 17 July. A total of 108 grizzly bears in 71 groups were observed during 79 hours of flying. Twenty-two females with young were observed during observation flights. Seven of these were initial observations of unduplicated females with cubs-of-the-year. Thirty-seven unduplicated females with cubs were identified during 2000. A total of 72 cubs were observed during the initial sightings of unduplicated females. Nine single cub litters, 21 litters of twins, and 7 litters of triplets were observed. Mean litter size was 1.9. Unduplicated females with cubs were observed in 14 of 18 Bear Management Units (BMU) within the grizzly bear recovery zone. Females with young were documented in all 18 BMUs. We documented 19 known, 1 probable, and 3 possible man-caused grizzly bear mortalities during 2000; 5 were management removals. Thirteen of the known and probable man-caused mortalities were related to big-game hunting activity within the GYA. Three known and 3 probable natural mortalities were documented. An

additional 4 grizzly bears (3 known and 1 possible) that died from unknown causes were discovered.

Project title: Food Habits and Habitat Use of the Yellowstone Grizzly Bear

Principal investigator: Dr. Charles Schwartz Contact info: see above

Additional investigator(s): Mark Haroldson, Shannon Podruzny, Doug Ouren

Objective: To determine habitat requirements for the Yellowstone grizzly bear and to document its return to free-ranging status.

Findings: These data include information collected by the Interagency Grizzly Bear Study Team (members include USGS-BRD, YNP, WYDGE, IDFG, MTDFWP, USFWS, USFS) for the entire Greater Yellowstone Area. Data obtained within YNP is not broken out separately: Surveys to determine an index of spring ungulate carcass availability were conducted during May. Approximately 300 km of transect routes were surveyed in four different ungulate wintering areas. A total of 44 elk, 4 bison, and 1 mule deer carcasses were observed for a rate of 0.13 ungulate carcasses/km. These results indicate a relatively small number of winter-killed ungulates were available to bears during spring 2000. Surveys for numbers of spawning cutthroat trout and their use by grizzly bears were conducted from mid May to early August on tributary streams to Yellowstone Lake. Numbers of spawning fish were average in most streams surveyed except those in the West Thumb area. Three hundred and eighty-six hair samples suitable for DNA analysis were collected near spawning streams. These samples are used to estimate of the number of individual grizzly bears that fish for spawning cutthroat trout. Results of the DNA analysis are expected by late spring 2001. Eighty-five individual grizzly bears have been identified visiting spawning streams from hair samples obtained between 1997 and 1999. Surveys of 18 whitebark pine cone productivity transects distributed throughout the GYA were completed during July. One transect was not read because of fire activity that closed the portion of the Gallatin National Forest where the transect was located. Mean cones per tree for the read transects were 5.7. This year's poor whitebark pine cone crop was offset partially by last year's near-record cone production. Grizzly bears throughout the GYA used last year's cones well into fall 2000. A total of 129 grizzly bear observations, including 10 family groups, were recorded at 17 of 46 (37 percent) of the known and/or suspected insect aggregation sites identified through 1999. Grizzly bears were observed digging in talus, presumable for moths, at two additional high elevation sites during 2000.

**Project title: Black Bear Demographics in Yellowstone National Park:
Their Interrelationship to Other Carnivores, Habitats, and Humans**

Principal investigator: Dr. Charles Schwartz
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Additional investigator(s): Mark Haroldson, Kerry Gunther, Glenn Plumb

Objective: 1) Determine patterns of habitat use, food habits, activity patterns, movements, and home

range size for a sample of randomly captured black bears; 2) 2. Evaluate the temporal and spatial patterns of habitat use of sympatric grizzly and black bears.

Findings: Three adult black bears (1 male, 2 females) were captured and fitted with Global Positioning System (GPS) collars during the fall of 2000. Seventeen aerial locations were obtained from these bears before they entered their winter dens. Detailed data on the movements of these bears will not be available until the store-on-board collars are retrieved during the summer of 2001.

Yellowstone Grizzly Bear Investigations for 1995-1999 are now available at <http://nrmssc.usgs.gov/research/igbst-home.htm>. The 2000 Annual Report will be available by mid summer 2001.